LOOKING BACK, AHEAD, AND IN NEW DIRECTIONS

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In this paper, I respond to and expand on Civil's plenary address (this volume), in which she articulates key themes related to funds-of-knowledge orientations to mathematics education. I review the themes selected by Civil: funds of knowledge, participation, and valorization of knowledge, and provide additional analysis. Next, I accentuate the often absent but inherent political dimensions of work in mathematics education that emphasizes the cultural, as well as the often absent but inherent cultural dimensions of work in mathematics education that emphasizes the political. Finally, I contribute additional perspectives to future directions for the research community around equity in mathematics education.

Keywords: Equity and Diversity

Introductions

I trace the origins of my work around equity in mathematics education to my involvement as an undergraduate student in a spin-off project prompted by the then-contemporary study, in which Treisman and colleagues (see Treisman & Fullilove, 1990) attributed difficulties in college mathematics for African American students to their social and academic isolation. In 1991, the mathematics department at the college where I was a student, inspired by Treisman's findings, created a co-curricular Calculus "workshop" for first-year students of color. I was tapped as a senior student facilitator, and this experience contributed towards my extension of experience in informal and Jewish education towards mathematics teaching as a profession.

I continue to benefit from the power and privilege that come with whiteness in the U.S., in opportunities around education, employment, and housing. Yet white privilege only goes so far for me, as a queer, gender non-conforming, Jewish woman. In general, through my intersecting life experiences of Otherness (Du Bois, 1903) and my struggles from these marginalized positions, I feel solidarity and identify with people and groups who are being othered, objectified, or oppressed. Once I became a high school mathematics teacher in the mid-1990s, for example, I discovered a system in the elite school in New York City where I taught that was supposedly ability oriented but had produced its lowest track with nearly all of the school's students of color. After sizing up their brilliance, the students and I turned what was supposed to be a low-track senior math class to preparing for and taking the AP Calculus AB exam. The impetus was certainly inspired by my achieved standpoint (Harding, 1993) as a queer Jew, and likely also in part by the then-contemporary *Stand & Deliver*.

In that popular Hollywood rendering of real-life Jaime Escalante's classroom, we saw Latinx students face racial discrimination as, presumed by the College Board to have been cheating, they were forced to retake their AP Calculus exams. Though my students and I were spared the attention of The College Board, they schooled me about the range of everyday racial discrimination and microaggressions they experienced, from regularly being called one another's names by white teachers, to being tailed inside stores by local shopkeepers, to being targeted by city truancy officers on route to school and then missing class while being "processed" by that system, to having to absorb the feeling of being feared on the streets by white women. My love for them as their teacher connected me in an emotional way to what was their marginalization, their pain, their disappointment. I wanted to teach mathematics that would feel relevant, to support their

and my own understandings of processes in the world, especially the structural and systemic processes that were designed to keep power and material resources from them.

In my subsequent and ongoing work as a mathematics education researcher and teacher educator, I continue to learn about the importance of providing students with windows through which to use mathematics to understand the outside world but also of mirrors, through which to see themselves and connections to their pasts and potential futures (Gutiérrez, 2007). As Gutiérrez (2007) elaborates: "The goal is not to replace traditional mathematics with a pre-defined 'culturally relevant mathematics,' but rather to strike a balance between the number of windows and mirrors provided to any given student in his/her math career" (p. 3). Otherwise, like the poet Adrienne Rich (1986) warns, without such "mirrors," there is the potential for "psychic disequilibrium" as the teacher, the school, the curriculum, and their aggregated power is describing the world, but without you in it, and it "as if you looked in the mirror and saw nothing" (p.199).

Since the 1980s, mathematics education research and teacher education has considered an array of related sociocultural perspectives about mathematics and its teaching and learning -- ethnomathematics (e.g., D'Ambrosio, 1985), funds of knowledge for mathematics (e.g., Aguirre et al., 2013; Civil, 1998), and culturally relevant or responsive mathematics teaching (e.g., Gutstein, Lipman, Hernández & de los Reyes, 1997). A commonality among these perspectives is around "centering" (Tate, 1995) mathematics on students' experiences, their affiliations with various cultural or social groups, or the everyday practices of those groups, by creating opportunities for hybridity between the mathematical thinking in everyday practices or other out-of-school domains and the formal school mathematics curriculum. Unlike an incremental or vertical development of mathematical expertise typical to school-based learning, horizontal expertise develops through coordination across the diverse set of contexts through which one traverses (K. Gutiérrez, 2008).

In this volume, Civil (2018) reflects on such a perspective about mathematics teaching and learning equity in mathematics education and identifies three interrelated themes that she views as central in her own "looking back": funds of knowledge; participation; and valorization of knowledge. I have been greatly influenced by Marta's corpus of scholarly contributions, and I begin by addressing each of these themes. Next, I follow Marta's lead and present ideas about how we might "look forward," or really, blaze new trails in mathematics education, in vision, mission, and action.

Civil's "Look Back"

Funds of Knowledge

Across the breadth of Civil's work, she emphasizes a baseline premise that every community, family, and person possess mathematical funds of knowledge, and that these funds of knowledge can be leveraged as intellectual resources for school success. This approach to equity in mathematics is considered "asset-based" (Celedón-Pattichis et al., 2018), in how it avoids a deficit construction of minoritized youth, their families, communities, and material spaces. Civil's research includes studies of children's mathematical thinking, mathematics teaching, and parents' mathematical thinking and perceptions, and draws on a blend of cognitive and sociocultural perspectives about learning. One of her most significant contributions to date is her work on immigrant parents' mathematical thinking, their cultural and linguistic funds of knowledge, their views about their children's mathematics education in the U.S., and implications for equity in mathematics education (e.g., Civil & Andrade, 2002; Civil & Bernier, 2006; Civil & Menéndez, 2011).

Much of the related scholarship around funds of knowledge in mathematics education is practice-oriented, around processes or implications for teacher education. Beginning with Moll, Amanti, Neff and Gonzalez' (1992) outline of a process for teachers as co-researchers to conduct home visits with the goal of identifying funds of knowledge, there exists a growing set of studies that present potential protocols for, and demonstrate the effectiveness of, similar approaches in teacher education (Aguirre et al., 2013; Civil & Andrade, 2002; Foote et al., 2013; Rubel, 2012; Turner & Drake, 2015; Turner et al., 2016). In aggregate, these studies guide teacher education in terms of how to foster orientations to teaching that value the funds of knowledge that youth bring to the classroom and in so doing, deflect prevalent deficit framings of minoritized peoples. In addition, these studies identify and analyze ways of supporting teachers in developing and improving instructional practices that leverage those knowledge funds as intellectual resources.

A related area of research comprises curriculum design fueled by a funds of knowledge orientation. The Math in Cultural Context project is an example, in which teachers, researchers, and Yup'ik elders co-designed elementary school mathematics curriculum around mathematics of Yup'ik cultural practices (Kisker et al., 2012). Less well-known examples around curriculum design based on community funds of knowledge can be seen, for example, in Katsap and Silverman's (2015) work with geometry curriculum using traditional Bedouin weaving and embroidery, or Massarwe, Verner and Bshouty's (2010) example of plane geometry curriculum with a focus on Arab art and design. Civil has endowed our field with a variety of such examples, such as elementary mathematics curriculum around the theme of construction (Civil, 2002) or garden-design (Civil & Kahn, 2001).

Curricular design that builds on students' funds of knowledge typically relies on iterative processes of studying one's students to identify funds of knowledge domains, identifying mathematics embedded in those everyday practices, and building curriculum that negotiates the connections and tensions between the mathematical thinking inherent to this domain and the desired school mathematics. Although such processes are productive as equity-directed instructional practices, they extend beyond the normative scope of a teacher's workload. As our research and collaborations with teachers accumulate evidence that such processes are essential, we must concurrently adjust the scale of teacher workload and advocate for teachers as our collaborators in this endeavor so that there is not a disconnect between the necessary and the realizable.

In this volume, Civil (2018) showcases an example of how a funds of knowledge domain emerged in her mathematics workshop for parents of school students. Civil learned from the parents that American wrench sizes are sized in inches and expressed as fractions. Ordering wrenches by increasing size is, therefore, equivalent to ordering fractions. Civil presents the comparison of wrench sizes as an authentic context that can elicit or support mathematical thinking about fraction comparison. Here, with respect to this wrench dimension example, Civil reiterates an essential tension that she has earlier described (e.g., Civil, 2007), between "preserving the purity of the funds of knowledge" and the mathematical goals of instruction, in terms of how a curricular focus on a real-world context might de-prioritize, limit, and constrain mathematical exploration and mathematical content.

This tension is derived, in part, by how lesson planning in mathematics is traditionally driven by a predefined set of mathematical definitions, concepts, and skills, and then so-called "real-world" examples are provided as afterthought applications. Curricular design around a social practice or a social theme takes the opposite starting-point, which in and of itself is new for teachers or designers (Nicol, 2002; Wager, 2012). I have negotiated this tension in my work with

mathematics teachers around a binary of teaching the real-world context in service of learning mathematics or teaching mathematics in service of learning about the world. In navigating that false binary, we lose sight of how we are teaching children: our children, the children of our neighbors, and young people all. Their collective well-being, their sense of being cared for, and how mathematics can support the development, cultivation, and refinement of their empathy, creativity, curiosity, and capacity to care for one another and the natural world could be our primary priorities.

Participation in Mathematics

Centering mathematics instruction on students using a funds of knowledge approach typically implies designing thematic curriculum around a selected socio-cultural domain. An alternative way that funds of knowledge can be leveraged in mathematics is in terms of using analogies during instruction that relate a mathematical object or process to students' existing knowledge but without focusing the curriculum thematically around that knowledge domain. For example, in one of my projects, I observed a teacher using one of her student's breakdancing hobby in relation to the mathematical concept of a triangle's center of mass (Rubel & Chu, 2012). The lesson was not organized around breakdancing, but the breakdancing funds of knowledge was used as an analogy to bridge students' experiences with a mathematical object and its definition. Similarly, the example in Moses and Cobb (2001) about using students' experiences with the public transit system as a means of learning integers was absent a thematic focus on the trains themselves.

Here, Civil (2018) presents an additional alternative, in her reminder that students from minoritized groups can engage in mathematical content that is devoid of thematic connection to specific lived experiences. She stresses that building on students' experiences and their funds of knowledge does not need to be limited to building a curriculum focused on a particular everyday practice, real-world artifact or process, but could be implemented through the ways that teachers organize their classroom for participation -- not necessarily what mathematical questions the students are considering, but what kinds of participation are being made available to them, and if or how those kinds of participation are in synch with or in opposition to their ways of participation in other aspects of their lives. For example, apprenticeship models of gaining expertise or assumptions of competence are endemic to various contexts and could be leveraged as resources for classroom learning (Civil & Khan, 2001; Kisker et al., 2012; Nasir, 2005).

I would like to draw attention to this point, especially in the context of current educational policies and mantras. We know that teachers' beliefs about students and about learning underlie how they think what doing mathematics is supposed to look like, and which forms of participation they will make available for their students (Hand, 2012; Rubel & Stachelek, 2018). The common perception of order and silence as prerequisites to learning mathematics constrains individual teachers' views about participation, can lead toward over-interpretation of student participation as off-task or disruptive, and typically results in didactic teaching (Hand, 2010). In this volume, Civil (2018) draws attention to a 7th grade classroom vignette in which she was the instructor and her students engage deeply with evaluating algebraic expressions. She credibly ascribes significance to the blend of humor, use of the students' home language, and *confianza* (trust) among participants.

Civil's observations remind me of my own, recent observations of two accomplished teachers of color, Ms. Hudson and Ms. Garcia (pseudonyms), who collaborated with me on a recent project. Civil's description of the family-like environment in that 7th grade classroom is reminiscent for me of the my sense of the atmosphere in Hudson's and Garcia's classrooms, notably different from the

classrooms of the 9 white teachers in that group of teachers. Hudson created a family-life atmosphere through her playfulness and use of youth or informal language. For instance, she would ask the class, "Can I mess with you now?" as a way of initiating a more complicated exercise. This playfulness initiated a kind of lightness and communicated both rapport, support, and a sense of challenge. Garcia also connected to her students through language, but in her case, she drew on strategically using Spanish (her and their first language), to translate mathematical terms, to check in with students about their emotional state, and to redirect behavior. Garcia positioned herself as a loving caretaker for her students by donning an apron around her waist, its pockets filled with pencils, erasers, and calculators for their use. Civil's description of her experience in that 7th grade class corresponds with my observations of Hudson and Garcia, and of the Lee example described in Clark, Badertscher, and Napp (2013). In sum, this suggests that we expand our understandings about fostering hybridity in mathematics classes through participation processes and language and that we could follow the guidance of expert teachers of color and their community cultural wealth (Burciaga & Kohli, 2018). Other kinds of "disruptions" of traditional learning environments, like situating formal learning in places outside of schools and classrooms, are likely productive as well in creating opportunities for hybridity (Ma, 2016).

Valorization of Knowledge

The research literature describes interventions and provides teacher education modules designed around supporting teachers about how to develop mathematics curriculum that builds on students' experiences or everyday practices (Aguirre et al., 2013; Rubel, 2012; Taylor, 2012). As part of this process, we are seemingly led to search in a cultural practice for what Noss, Hoyles and Pozzi (200) have called "visible mathematics," meaning recognizable as school mathematics. Here and in other papers, Civil draws attention to the valorization of knowledge, in terms of the issue of whose knowledge is being valued, meaning that oftentimes we do not sufficiently valorize the mathematical thinking endemic to various cultural practices as mathematics. For example, one of Civil's exemplar funds of knowledge examples relates to a parent's geometric design and measurement work as a dressmaker (Civil & Andrade, 2002). As Civil has discussed, there is a distinction between valorizing the dressmaker's knowledge as itself mathematical or doing so through potential connections to existing school mathematics.

At the same time, Civil cautions about organizing lessons around a real-world context and then have the context "take over" the mathematics. Civil cautions that the social context might be superficial or contrived and draws attention to the oft stated concern "where is the math?" Elsewhere (Rubel & McCloskey, under review), I have written about how the "where is the math?" critique is at times employed to protect Western mathematics as if it were universal and as if success in school mathematics were inherently fair. Culturally relevant pedagogy, or pedagogy organized around funds of knowledge, is then positioned as communicating a "watering-down" of mathematics, for those seen as unable or unwilling to engage otherwise. Here, in reiterating her "where is the math?" concern, Civil comes close to positioning instruction and pedagogy that is fundamentally oriented around building on students' experiences as potentially at odds with rigorous mathematics instruction. When we position culturally relevant pedagogy as threatening mathematics, we falsely re-inscribe Western mathematics as neutral and deny that school and academic mathematics are historically, socially, spatially, and culturally bounded.

Indeed, while ethnomathematics could focus on the mathematics of *any* social or cultural group, it is typically used as a catch-all term for mathematics among "identifiable cultural groups" (D'Ambrosio, 1985), and those groups are typically limited to subordinated social groups (Knijnik,

1997). Western mathematics is then understood as separate from and in opposition to ethnomathematics (Gutiérrez, 2017). But as Knijnik (2002) explains:

by considering the form of other, non-hegemonic ways of knowing and producing mathematics, ethnomathematics relativises the "universality" of (academic) mathematics and, moreover, questions its very nature. ... In problematising academic mathematics, ethnomathematics emphasizes not only that mathematics is a social construction but, more than this, that such a construction takes place in a terrain shaped by political dispute around what will be seen as mathematics, around which will be considered the legitimate way of reasoning, and therefore, around which groups are those that can legitimately produce science.....Thus, it is not a matter of talking naively about different mathematics, but of considering that these mathematics are, in terms of power, unequally different. (p.13)

Hence, if we legitimize mathematical funds of knowledge only in terms of connections to Western mathematics, we are ignoring this political terrain. Using a Western gaze onto our students' funds of knowledge is different than valorizing cultural expertise, curiosity, and other ways of knowing as avenues that will yield new mathematical questions, ideas, representations, and ways of knowing. I call attention to the work of R. Gutiérrez (2002) in which she outlines how making space for people "under the tent" of mathematics will necessarily change, expand, and improve mathematics -- people pose mathematical questions and develop mathematical solutions informed by their experiences. Mathematics is necessarily enriched by participation of a wider variety of people from a broader range of experiences. As Gutiérrez teaches, it is not only that marginalized people need mathematics. Of course, they can use mathematics in a variety of ways to evade their marginalization. However, for mathematics to stay relevant and to be able to solve many problems that remain unsolved, it is mathematics that needs a diversity of peoples.

The Cultural is Political

Although mathematics is an ongoing human creation, only some mathematics is recognized in the Western cannon and included in school curriculum. For students in the U.S., from the White, Christian power-majority, this is not experienced as exclusion, since this is the normative culture. Teachers (as well as textbooks and test writers), who are largely from that power-majority, tend to draw on their own funds of knowledge in selecting, creating, and implementing mathematical tasks. In sum, this means that white students already have their funds of knowledge reflected in typical mathematics instruction and curriculum, without need of intervention and unacknowledged as such. Even when trying to connect to students' funds-of knowledge, mathematics teachers have been found to contextualize mathematics using contexts related to sports or consumer activities of adults like home remodeling, shopping, banking, or budgeting (Bright, 2015; Watson, 2012), domains that are seemingly "safe," or germane for everyone in the same way. However, these domains are neither arbitrary nor neutral, but correspond to the interests, life experiences, and values of communities who already benefit from being part of the power-majority. Moreover, the positioning of the importance of learning mathematics in school as preparation for roles as marketplace consumers or corporate employees demonstrates how mathematics in schooling is being used to support ideologies of individualism, competition, and capitalism, ideologies that benefit that same white power-majority. How might our word problems in mathematics read if they were guided instead around commitments to collective well-being or to the health of our natural environment?

Making the Political Explicit

There is a known tendency to avoid political questions like these in the teaching of mathematics (e.g., Simic-Miller, Fernandes, & Felton-Koestler, 2015), which can be explained by a combination of a lack of sociopolitical awareness among teachers, fear among teachers for job security especially in the current nationalistic climate, or a result of the common misperception that mathematics is apolitical. In one of my projects, for example, I observed teachers struggle with how to take up issues of power and oppression in their teaching of mathematics for all of these reasons. One white teacher with whom I collaborated, for example, created interesting curriculum around using geometric loci as a language with which to analyze or design home or facility location, relative to constraints like environmental pollution. Even though her school was in a low-income area with high asthma rates, presumed to be related to more extreme and multiple sources of environmental pollution, she built the lesson in hypothetical, generic terms. In conversation afterwards, she agreed that she could have provided the students the opportunity to use mathematics to articulate their own physical geometries in the context of actual existing environmental hazards and disease rates. She reflected that she tended to have "blinders on" about specifically engaging in hybridity between relevant political concerns and her teaching of geometry (see Rubel, 2017). I, too, as a teacher educator struggle with how to better support teachers in this regard.

Indeed, despite a vision of mathematics as socially constructed with political ambitions and consequences, funds of knowledge projects in the literature are often described in cultural or linguistic terms absent explicit socio-political contextualization. For example, taking Civil's (2018) new example about wrench sizing, she has demonstrated that this is an interesting and likely productive context in which to explore comparison of fractions. The wrenches, and what they are used for, as well as who is using them is seemingly put aside to focus on the wrench dimensions themselves, because fractions and their relative magnitudes explicitly reside in those dimensions. But what of the unasked question as to the mathematics of why these people, in this moment of time, and in this place possess this specific knowledge about hand tools? What is the mathematics of how this knowledge and expertise is capitalized on by those in power? What is the mathematics of who owns the construction or tool companies, who gives the building permits, and what the zoning processes value? How is this knowledge acquired and how is it shared? Who invented this tool, for what purpose, and how is mathematics used to produce it? What fraction of construction profit goes to those who are doing the actual back-breaking and dangerous construction labor? What is the mathematics of labor unions in the U.S. and their support for construction workers? What else are these tools used for? And further, what is the mathematics of American persistence to have a unique measurement system?

The Political Crowding Out or Denigrating the Cultural

It is not only that funds-of-knowledge curriculum modules are often presented absent political context. There are examples in the literature of projects that are explicitly organized around political questions or themes but that do not honor or sufficiently leverage students' funds of knowledge. In my work with colleagues, as part of the City Digits project, for example, we identified widespread participation in state lottery games as a cultural fund of knowledge in which to explore probability, combinations, scale, measurement, data analysis with youth (see Rubel, Lim, Hall-Wieckert, & Sullivan, 2016c). In a second example, we drew on rampant participation in a local array of alternative financial institutions like pawn shops and check cashers as an entry-point to evaluate spatial distribution of these alternative financial institutions in the context of other social variables (Rubel, Lim, Hall-Wieckert, & Katz, 2016b). In both

cases, students built new or more developed mathematical understandings, which contributed to furthering their political formation (Rubel, Hall-Wieckert, & Lim, 2017). Their interest in and curiosity about spatial justice engaged them in furthering their mathematical understandings (Rubel, Lim, Hall-Wieckert, in press). Participating students reflected that contextualizing mathematics through political issues that they identified as connected to their lives and the places in which they live -- their funds of knowledge -- linked their learning to their sense of being agents of change in their families in terms of lottery spending, or decisions about financial institutions (Rubel et al., 2016c).

At the same time, along with these important successes, these curricular modules and their associated maps did not make sufficient use of funds of knowledge as resources and instead, likely reinforced and highlighted common deficit notions about students and their families, at least for some students. For example, central to these modules were data and map representations that could have been interpreted as suggesting that participation in the lottery or loan-taking from alternative financial institutions among low-income people are produced by a lack of mathematical understanding, instead of as products of spatial injustice organized to maintain the status-quo of white supremacy (Rubel, Hall-Wieckert, & Lim, 2016a). The knowledge that the youth accessed in the community about people's sense of hopelessness in the context of their care for loved ones remained largely in the shadows of the project's focus on navigating probability and combinatorics ideas or on the mathematics of loans. How could mathematics be directed at questions or problems related to hope or love instead of only on analysis of or strategies about capital gain amd loss?

As another example, consider Cirillo, Bartell, and Wager's (2016) presentation of a mathematical modeling investigation around the theme of soda pricing techniques used by fast food restaurants. By presenting data showing drink volume and corresponding price per ounce. the finding is that over-sized drinks are sold at a cheaper rate per ounce than smaller, recommended sizes, effectively enticing consumers to buy larger drinks. Since these drinks are heavily caloric but without other dietary benefits, this becomes significant relative to obesity, diabetes, and other health factors. Cirillo et al. (2016) direct readers to contextualize this finding in terms of the density of fast food restaurant locations relative to demographic variables around income, and speculate, indeed, that students in low-income areas saturated with fast food restaurants might surmise that there is not concern for their health. Educating people about their miniscule probability of winning the lottery can be seen as using mathematics to promote abstinence from the lottery. This is akin to how teaching that interest rates charged by pawn shops or check cashers are higher than other financial institutions might lead people to borrow money elsewhere. Similarly, educating people about this value pricing of soft-drinks technique relative to the health risks of drinking soda is intended to guide learners towards abstinence from indulging in those drinks. A commonality across these types of mathematical investigations is that they do not directly challenge why we accept a society that allows, supports, and even encourages these kinds of predatory systems.

Fundamental to this distinction is our current paradigm of democracy, which is a power-over system (Guinier & Torres, 2002), meaning that competition for power yields some who dominate and more who are dominated. Even if one assumes that the current democratic systems in the U.S. are fair and meritocratic, still, these systems are designed to generate inequalities, to yield rewards only to some, and mathematics supports these systems that are designed to rank and order of people (see Valero, 2017). One could argue that teaching young people to understand the lottery as a social project, for example, which necessitates various mathematical

understandings, is a way to bolster them in this competitive "power-over" notion of democracy. It is one thing to support youth in navigating the world and its systems as they are, but it is another thing to challenge this underlying conception of democracy. The power-over paradigm could be replaced with a "power-with" democracy (Guinier & Torres, 2002), in which the focus on the individual were shifted to a focus on the collective, wherein an essential value around competition among individuals were replaced with solidarity, resistance, and collective struggle. What would happen to our state-supported lottery systems, our loaning institutions, our fast-food restaurants and their pricing techniques, for example, if our democracy were "power-with" instead of "power-over"? How can mathematics help us to advocate for such a paradigm shift?

Next Steps

In summary of next steps, Civil (2018) reiterates the set of political acts from Aguirre et al. (2017): "1) enhance mathematics education research with an equity lens, 2) acquire the knowledge necessary to do genuine equity work, 3) challenge the false dichotomy between equity and mathematics, and 4) expand the view of what counts as mathematics." Civil's reflections, as well as my comments above, are largely concentrated around the latter two political acts. Inspired by Political Acts #3 and #4 in particular, Civil asks: "Are we doing enough in our writing and in our work to bring the centrality of equity to mathematics and the centrality of mathematics to equity?"

I opened this piece by citing perspectives about learning that guide us in terms of giving students opportunities to draw on their cultural and linguistic funds of knowledge as resources in mathematics. I cited Gutiérrez' (2002) call that we need to offer mathematics as a window through which students can look out onto the world, but also as a mirror in which students can see themselves, their families, their pasts, and their futures in mathematics. And yet, the notion of mathematics as a mirror through which to see self seems not yet fully possible. For example, I have bumped up against the gender binary in and with mathematics, by mathematics teachers, by mathematics exercises and theories that indicate and support a set of untruths (see Rubel, 2016). School mathematics tells me that I was born either a boy or a girl, and that this is a fixed state. Schooling in the U.S. prescribes that liking or doing math is doing masculinity, and that girls can excel at math but at the cost of sacrificing femininity. School mathematics decries sexuality, race, and ethnicity as irrelevant, and that success in school mathematics is determined by a fundamentally meritocratic system. In these and other ways, mathematics, even as a mirror, distorts reality. I never felt safe enough to come out as queer as a classroom teacher, and my physical and material vulnerability remain an issue, especially in the current political context. Mathematics, windows or mirrors, does not protect me, and if anything, my work and interest in mathematics likely make my ideas *more* threatening and put me in greater danger than if I worked in education research around another school discipline. In the U.S., where mathematics is intertwined with white supremacy, patriarchy, and heteronormativity, my scholarly critiques, my publicly funded salary, and even my basic existence pose a challenge to that constellation of hegemonic forces.

And so, what of the centrality of mathematics to equity and equity to mathematics? This circles back to the first two Political Acts from Aguirre et al., 2018, which speak to our participation as mathematics education researchers in the current political context. There is the constant evidence of hegemony across mathematics education in the U.S. of review panels, editorial boards, plenary panels, and faculty rosters comprised largely or exclusively of white, CIS, straight, Christian, gender-normative people. We must acknowledge that by limiting who participates in knowledge-building, including through entrenched processes of institutional

elitism in the academy, we limit the knowledge building itself. Peruse the research that I have cited in and across this paper as well as the references cited in this volume by Civil - in nearly all cases, cited works are written by people from minoritized groups. Of course, it is reasonable and appropriate that these scholars lead the field in thinking about equity -- after all, we build knowledge in part on our own life experiences, the standpoints we have achieved, and we draw from our own marginalization to recognize when, where, and how it happens to others (Harding, 1993). Those of you who are part of the power majority, either by being male, white, Christian, straight, gender-normative, or tenured faculty at a research university: how might the workings of our field be different and the knowledge we produce improve if we made space for other bodies and voices, listened to critiques, were better allies and advocates, or if we ceded, or at least shared, power with others who do not share our privileges?

Instead of token nods of inclusion, we should blaze new trails for our research community by shaping our research agendas, methodologies, avenues for sharing knowledge, and ways of collaborating around a priority of *tikkun olam* (Hebrew for "repair the world.") and collective productivity. We could refashion our national and international leadership around a vision for mathematics education that focuses on cultivating kindness, empathy, curiosity, creativity, and collaboration among people in a power-with democracy. That way, we would create mathematics that helps in posing and solving pressing questions about our natural environment and our wellness. As importantly, we would know when to put aside mathematics for other, better suited tools or ways of knowing. Perhaps instead of, or at least in parallel to, the oft-asked "where's the math?" challenge, thinly veiled as a question, we ought to invoke the inverse challenge: "where's the justice?" After all, if a research project does not engage equity, privilege, power or justice, and is not contributing toward repairing our world, then how can such research be relevant to mathematics education?

References

- Aguirre, J. M., Turner, E. E., Bartell, T. G., Kalinec-Craig, C., Foote, M. Q., Roth McDuffie, A., & Drake, C. (2013). Making connections in practice: Developing prospective teachers' capacities to connect children's mathematical thinking and community funds of knowledge in mathematics instruction. *Journal of Teacher Education*, 64(2), 178-192.
- Aguirre, J., Herbel-Eisenmann, B., Celedón-Pattichis, S., Civil, M., Wilkerson, T., Stephan, M., Pape, S., & Clements, H. D. (2017). Equity within mathematics education research as a political act: Moving from choice to intentional collective professional responsibility. *Journal for Research in Mathematics Education*, 48(2), 124-147.
- Burciaga, R. & Kohli, R. (2018). Disrupting whitestream measures of quality teaching: The community cultural wealth of teachers of color. *Multicultural Perspectives*, 20(1), 5-12.
- Bright, A. (2015). Lift every voice and sing. A response to "Mathematics for what? High school students reflect on mathematics as a tool for social inquiry." *Democracy and Education, 23*(1), Article 8.
- Celedón-Pattichis, S., Peters, S., Borden, L., Males, J., Pape, S., Chapman, O., Clements, D., Leonard, J. (2018). Asset-based approaches to equitable mathematics education research and practice. *Journal for Research in Mathematics Education*, 49(4), 373–389.
- Cirillo, M., Bartell, T., Wager, A. (2016). Teaching mathematics for social justice through mathematical modeling. In C. Hirsch & A.R. MacDuffie (Eds.) *Mathematical modeling and modeling mathematics* (pp. 87-96). Reston, VA: NCTM.
- Civil, M. (1998). Bridging in-school mathematics and out-of-school mathematics, presented at the *Annual Meeting of the American Educational Research Association*, San Diego, CA. Accessed at https://files.eric.ed.gov/fulltext/ED425066.pdf
- Civil, M. (2002). Culture and mathematics: A community approach. *Journal of Intercultural Studies*, *23*, 133-148. Civil, M. (2006). Working towards equity in mathematics education: A focus on learners, teachers, and parents. In S. Alatorre, J. L. Cortina, M. Sáiz, & A. Méndez (Eds.), *Proceedings of the twenty-eighth annual meeting of the*

- North American Chapter of the International Group for the Psychology of Mathematics Education (Vol. 1, pp. 30-50). Mérida, Mexico: Universidad Pedagógica Nacional.
- Civil, M. (2007). Building on community knowledge: An avenue to equity in mathematics education. In N. Nassir & P. Cobb (Eds.), *Improving Access to Mathematics: Diversity and Equity in the Classroom* (pp. 105-117). New York, NY: Teachers College Press.
- Civil, M., & Andrade, R. (2002). Transitions between home and school mathematics: Rays of hope amidst the passing clouds. In G. de Abreu, A.J. Bishop, and N.C. Presmeg (Eds.), *Transitions between Contexts of Mathematical Practices* (pp. 149-169). Boston, MA: Kluwer.
- Civil, M., & Bernier, E. (2006). Exploring images of parental participation in mathematics education: Challenges and possibilities. *Mathematical Thinking and Learning*, *8*, 309-330.
- Civil, M., & Kahn, L. (2001). Mathematics instruction developed from a garden theme. *Teaching Children Mathematics*, 7, 400-405.
- Civil, M., & Menéndez, J. M. (2011). Impressions of Mexican immigrant families on their early experiences with school mathematics in Arizona. In R. Kitchen & M. Civil (Eds.), *Transnational and Borderland Studies in Mathematics Education* (pp. 47-68). New York, NY: Routledge
- Clark, L., Badertscher, E. M., & Napp, C. (2013). African American mathematics teachers as agents in their African American students' mathematics identity formation. *Teachers College Record*, 115(2), 1–36.
- D'Ambrosio, U. (1985). Ethnomathematics and its place in the history and pedagogy of mathematics. *For the Learning of Mathematics*, *5*(1), 44–48.
- DuBois, W.E.B. (1903). The souls of Black folk. Chicago: A.C. McClurg & Co.
- Foote, M. Q., Roth McDuffie, A., Turner, E. E., Aguirre, J. M., Bartell, T. G., & Drake, C. (2013). Orientations of prospective teachers towards students' families and communities. *Teaching and Teacher Education*, *35*, 126-136
- Gutiérrez, K. (2008). Developing a sociocritical literacy in the Third Space. *Reading Research Quarterly*, 43(2), 148–164.
- Gutiérrez, R. (2002). Toward a new equity research agenda. *Mathematical Thinking and Learning*, 4 (2&3), 145–87. Gutiérrez, R. (2007). Context matters: Equity, success, and the future of mathematics education. In T. Lamberg & L. P. Wiest (Eds.). Proceedings of the 20th annual meeting of the North American Chapter of the International
- R. Wiest (Eds.), *Proceedings of the 29th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education* (pp. 1–18). Stateline (Lake Tahoe), NV: University of Nevada, Reno.
- Gutiérrez, R. (2017). Living mathematx: Towards a vision for the future. In Galindo, E., & Newton, J., (Eds.). (2017). Proceedings of the 39th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education (pp. 2-26).. Indianapolis, IN: Hoosier Association of Mathematics Teacher Educators.
- Gutstein, E., Lipman, P., Hernández, P., & de los Reyes, R. (1997). Culturally relevant mathematics teaching in a Mexican American context. *Journal for Research in Mathematics Education*, 28, 709–737.
- Hand, V. M. (2010). The co-construction of opposition in a low-track mathematics classroom. *American Educational Research Journal*, 47(1), 97–132.
- Hand, V.M. (2012). Seeing culture and power in mathematical learning: Toward a model of equitable instruction. *Educational Studies in Mathematics*, 80(1&2), 233–247.
- Harding, Sandra. (1993). Rethinking standpoint epistemology: What is "strong objectivity"? In L. Alcoff & E. Potter (Eds.), *Feminist epistemologies* (pp. 49–82). New York: Routledge.
- Katsap, A. & Silverman, F. (2015). *Ethnomathematics of Negev Bedouins' Existence in Forms, Symbols and Geometric Patterns*. Rotterdam: Sense Publishers.
- Knijnik, G. (1997). Ethnomathematics: Culture and politics of knowledge in mathematics education. For the *Learning of Mathematics*, 22(1), 11-14.
- Kisker, E. E., Lipka, J., Adams, B. L., Rickard, A., Andrew-Ihrke, D., & Yanez, E. E. (2012). The potential of a culturally based supplemental mathematics curriculum to improve the mathematics performance of Alaska native and other students. *Journal for Research in Mathematics Education*, 43(1), 75–113.
- Ma, J. (2016). Designing disruptions for productive hybridity: The case of walking scale geometry. *Journal of the Learning Sciences*, 25(3), 335–371.
- Massarwe, K., Verner, I., & Bshouty, D. (2010). An Ethnomathematics exercise in analyzing and constructing ornaments in a geometry class. *Journal of Mathematics & Culture*, 5(1).
- Moses, R. P., & Cobb, C. E. (2001). *Radical equations: Math literacy and civil rights*. Boston, MA: Beacon Press. Nasir, N. S. (2005). Individual cognitive structuring and the sociocultural context: Strategy shifts in the game of dominoes. *Journal of the Learning Sciences*, 14(1), 5–34.
- Hodges, T.E., Roy, G. J., & Tyminski, A. M. (Eds.). (2018). *Proceedings of the 40th annual meeting of the North American Chapter of the International Group for the Psychology of Mathematics Education*. Greenville, SC: University of South Carolina & Clemson University.

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- Nicol, C. (2002). Where's the math? Prospective teachers visit the workplace. *Educational Studies in Mathematics*, 50, 289–309.
- Noss, R., Hoyles, C. and Pozzi, S.: (2000). Working knowledge: Mathematics in use. In A. Bessot and J. Ridgway (Eds.), *Education for Mathematics in the Workplace (pp. 17-35)*. Dordrecht: Kluwer.
- Rich, A. (1986). Blood, Bread, and Poetry: Selected Prose, 1979-1985. New York: W. W. Norton.
- Rosebery, A., Warren, B., & Conant, F. (1992). Appropriating scientific discourse: Findings from language minority classrooms. *Journal of the Learning Sciences*, 2(1), 61–94.
- Rubel, L. (2012). Centering the teaching of mathematics on urban youth: Learning together about our students and their communities. In J. Bay-Williams & R. Speer (Eds.), *Professional Collaborations in Mathematics Teaching and Learning: Seeking Success for All* (NCTM 2012 Yearbook). Reston, VA: National Council of Teachers of Mathematics.
- Rubel, L. (2016). Speaking up and speaking out about gender. Mathematics Teacher, 109(6): 434-439.
- Rubel, L. (2017). Equity-directed instructional practices: beyond the dominant perspective. *Journal of Urban Mathematics Education*, 10(2), 66-105.
- Rubel, L., & Chu, H. (2012). Reinscribing urban: High school mathematics teaching in low-income communities of color. *Journal of Mathematics Teacher Education*, 12(1), 39–52.
- Rubel, L., Hall-Wieckert, M., & Lim, V. (2016a). Teaching mathematics for spatial justice in urban schools: Beyond a victory narrative. *Harvard Educational Review*, 86(4), 556–579.
- Rubel, L., Hall-Wieckert, M., & Lim, V. (2017). Making space for place: the role of mapping tools in learning as political formation. *Journal of the Learning Sciences*, 26(4). 643-687.
- Rubel, L., Lim, V., & Hall-Wieckert, M. (In press). "So we only have one we share with more, and then they have way more and they share with less": Mathematics and spatial justice. In T. Bartell & K. Bieda (Eds.) *Toward equity and social justice in mathematics education*. New York: Springer.
- Rubel, L., Lim, V., Hall-Wieckert, M., & Katz, S. (2016b). Cash across the city: Participatory mapping & teaching for spatial justice. *Journal of Urban Learning, Teaching & Research*, 12(1), 4–14.
- Rubel, L., Lim, V., Hall-Wieckert, M., & Sullivan, M. (2016c). Teaching mathematics for spatial justice: An investigation of the lottery. *Cognition & Instruction*, *34*(1), 1–26.
- Rubel, L., & Stachelek, A. J. (2018). Tools for rethinking classroom participation in secondary mathematics. *Mathematics Teacher Educator*, 6(2), 8-23.
- Simic-Muller, K., Fernandes, A., & Felton-Koestler, M. (2015). "I just wouldn't want to get as deep into it": Preservice teachers' beliefs about the role of controversial topics in mathematics education. *Journal of Urban Mathematics Education*, 8(2), 53–86.
- Tate, W. F. (1995). Returning to the root: A culturally relevant approach to mathematics pedagogy. *Theory Into Practice*, *34*(3), 166–173.
- Treisman, U. & Fullilove, R. (1990) Mathematics achievement among African American undergraduates at the University of California, Berkeley: An evaluation of the mathematics workshop program. *Journal of Negro Education*, 59 (3), 463-478.
- Turner, E. E., & Celedón-Pattichis, S. (2011). Mathematical problem solving among Latina/o kindergarteners: An analysis of opportunities to learn. *Journal of Latinos and Education* 10(2), 146–169.
- Turner, E. & Drake, C. (2015). A review of research on prospective teachers' learning about children's mathematical thinking and cultural funds of knowledge. *Journal of Teacher Education*, 67, 1, 32-46.
- Turner, E. E., Foote, M. Q., Stoehr, K. J., Roth McDuffie, A., Aguirre, J. M., Bartell, T. G., & Drake, C. (2016). Learning to leverage children's multiple mathematical knowledge bases in instruction. *Journal of Urban Mathematics Education*, *9*(1), 48-78.
- Valero, P. (2017). Mathematics for all, economic growth, and the making of the citizen-worker. In T.
- S. Popkewitz, J. Diaz, & C. Kirchgasler (Eds.), *A political sociology of educational knowledge: Studies of exclusions and difference* (pp. 117-132). New York: Routledge.
- Wager, A. (2012). Incorporating out-of-school mathematics: From cultural context to embedded practice. *Journal of Mathematics Teacher Education*, 15(1), 9–23.
- Watson, D. (2012). Norming suburban: How teachers talk about race without using race words. *Urban Education*, 47(5), 983–1004.